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Micrion

October 4, 1991

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Dear Marty:

This is the 11th bimonthly report detailing work done on contract N00014-89-C-2238 during August and September, 1991.

3.31 Advanced Column Development

We have built and are testing two production prototype columns, the second one built for commercial use and not under the X-ray contract. Both columns are running well - we routinely measure spot sizes of 30 +/- 5 nm, and have resolved 250Å features. At present the resolution is limited by vibrations on the test stand.

The Micrion designed aperture selection mechanism was installed on the production prototype column, and we have developed a successful column alignment technique. The mechanism is smooth and has a positional repeatability of +/- 0.8 um.

A source assembly was built and installed on the production prototype column. The source was turned on and produced a beam the first time, and the assembly has been successfully operational for over 100 hours.

3.32 Repairs

The JEOL field emission SEM has been used a high percentage of time recently to begin statistical evaluation of edge finding analysis and subsequent repair placement. The initial statistics are very encouraging. The first set of measurements were made by measuring displacement of an edge, and taking the measurement directly off of an SEM micrograph. The data spread was quite narrow except for one data point per group. We have determined that a probably cause for the 'outlying' point is in the software algorithm and we will be testing this in October. We will also evaluate edge analysis and repair placement by using a CD software package and by using the SEM in TSEM mode as developed by M.Postek et al at NIST.

During the summer we repaired a number of manually located defects on an IBM X-ray mask. It was exposed at Brookhaven onto a resist coated chrome/quartz substrate. This is not an optimum sample for SEM work: in addition, residual resist remained. We have more sample preparation to do at Micrion before we can finish the defect repair-exposure analysis.

3.33 System Stability
Nothing was done on this task.

3.34 and 3.35 Electronics and Software
We have begun the design review for the 0.25 um X-ray mask repair system, specifically what electrical harnesses, mechanical adaptations, and software development are required to properly link the 0.25 um subsystems to the base system.

Though we anticipate that we will be leaving the 0.5 um repair system intact and available to other users in the X-ray community, we are designing the 'links' such that we can retrofit the subsystems to the 0.5 um system if necessary.

OTHER

- The KLA-Micrion link is still not well-established. The second set of inspection data of the 1 um test pattern still could not be verified. We have only agreed on 2 out of 20 defects common to inspection of the test pattern and location on the mask in the Micrion tool. Further the difficulty is compounded in that KLA's coordinates are not in a universal set of axis and Micrion must mathematically transform the KLA coordinates in order to locate the actual position of each defect.

Enclosed are reprints of two papers on X-ray mask repair which were presented at SPIE's BACUS symposium in September 1990 and at SPIE's Microlithography conference in March, 1991.

Sincerely

Diane K. Stewart
X-ray Program Manager

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